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A PROPOSED PLUS-TREE REGISTER FOR THE PACIFIC NORTHWEST

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The registration of elite trees and plus trees is established practice in the species-improvement program of western European countries, and it is now getting under way in many parts of the United States.

For the most rapid development of tree improvement in the Northwest, the plus trees, or the very finest specimens in our natural stands in each locality, should be made available for a pollen supply, and to provide cuttings for seed-orchard development. This can best be accomplished by seeking out the best trees and listing them in a tree registry. For use in a locality, plus trees will necessarily be selected from rather restricted climatic zones; these will coincide with seed-collection zones discussed more fully later in this report.

Various agencies and private companies have already located plus trees and will register them. The Pacific Northwest Forest and Range Experiment Station is prepared to set up a central register for plus trees from experimental forests and the national forests of Washington and Oregon. Agencies who do not have registration facilities, or those who have their own register but wish to send copies of their records to the Station central registry, may feel free to do so. The following pages outline the proposed plan for setting up this register.

Procedure in Selecting and Registering Plus Trees

General guidance for the selection of plus trees may be obtained from "Selecting Plus Trees for Our Seed Orchards" by J. W. Duffield, and "Tentative Guides for the Selection of Plus Trees and Superior Stands in Douglas-fir" by Leo A. Isaac; both are now about ready for distribution. There are many other similar publications. The term "exceptional tree" about summarizes the entire procedure, and special skill is not required to select and present a candidate tree for registration. Skill and training will be required for the later genetic rating of the tree.

A proposed "plus-tree registration form" has been prepared, and a copy follows. It contains space for recording essential information, including sketch map grill for location and space for a photograph. General information such as location, tree description, stand description, etc., should be sent in when the tree is discovered and reported. A sheet of instructions accompanies this form. Suggestions for improvement of the form should be sent in so that they may be incorporated into later revisions.

When this article has been distributed and plus-tree registration gets under way, the plus-tree registration form and instruction sheet will be reproduced separately. For each tree, a set can be filled out with copies for the national forest, the company, or the agency files, and a copy sent in for registration. Copies of the form will be available upon request from this Station, and it is also probable that individual national forests or companies will reproduce the registration form under their own letterhead for the use of their field men.

Plus-Tree Rating

At the Northwest Forest Genetics Association meeting on February 18, 1955, it was suggested that they sponsor this plus-tree register movement and have a plus-tree rating board appointed from among its members at some later date. The board would be composed of technicians from different parts of the region. They would arrange for at least one of their members to field check candidate trees in his locality before a tree is given a rating. This group could then meet from time to time, not to approve or reject candidate trees, but to rate them on various characteristics according to the best available information.

Further study is necessary to work out the best system of rating. It will, in the beginning at least, be a relative rating--comparing the characteristics and performance of a tree with that of its neighbors. Geneticists as a rule are interested only in high rating trees, but sometimes trees are high in one respect and low in others; therefore, it seems logical to start with an average tree. In order to have something to start with, a suggested numerical system is shown on the back of the registration form. The average tree will be given a value of 1, the better-than-average or superior trees will be given values of 2 and 3 (the dominants), and the superlative tree that outstrips all its neighbors will be given a value of 4. If possible, a tree should be rated on at least the first five items listed on the form. The ratings will not be totaled or averaged.

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PLUS-TREE REGISTRATION FORM

Local No. _____ Central Registry No. _____

Species _____ Date _____

Local name of tree _____ By _____

Ownership _____ Seed zone No. _____

Nearest town _____ Nearest weather station _____

T. _____ R. _____ Sec. _____ Lat. _____ N. Long. _____ W. _____

Elevation _____ Exposure _____ Percent of slope _____ Site class _____

Soil _____

Tree Description: Age _____ D.b.h. _____ Total height _____

Bole: Ht. to 1st limb _____, straight _____, crooked _____, smooth _____, or rough _____

Bark: Rough _____, smooth _____, or average _____, in comparison with neighbors.

Crown: Live length _____ ft., pointed top _____, round top _____, sides flat _____, wedge shape _____

Limb angle with stem in upper one-third of crown in degrees _____

Thrift: Good _____ or exceptional _____. Needles dark green _____ or light green _____

Density: Limbs small _____ average _____ large _____, Average No. per whorl _____

Nearest other dominants: Age _____ D.b.h. _____ Height _____

(If measured) . " " "

" " "

" " "

Stand Description: (Species) _____

Average age _____ Average D.b.h. _____ Average height _____ Trees per acre _____

Individuals that know location and have supervision: _____

Remarks: Why was tree selected? _____

Location - Sketch Map

T. _____ R. _____ Sec. _____ Subdiv. _____

Photograph

(Scale: 1 inch = _____)

(Do not write in this space)

Rating^{1/}

Growth rate

Bole form

Crown form

Branch angle

Thrift

Resistance to disease

Resistance to insects

Flowering

Seed Production

Signed _____

Plus tree

^{1/} Proposed numerical rating on scale of 1 for the average tree to 4 for superlative tree. Not to be totaled or averaged.

(Scale: 1 inch = 20 feet)

O Plus tree position in stand
X Other trees in stand

Instructions for Filling Out Plus-Tree Registration Form

- Local No.: Given when discovered - often a ranger district, company, or agency will report a number of trees, and keep their own numbers. Registration numbers given when received.
- Species: Give common and scientific name.
- Local name: Outstanding trees often have a local name - The Glenwood pine, etc.
- By: Name of man who discovered or reported tree should be recorded.
- Ownership: Name of landowner should be recorded.
- Seed zone numbers are added to help in locating trees and in the general grouping of trees for use in a locality. (Seed zone map and descriptions follow.)
- Location: Weather station, permanent-Government or other. Latitude and longitude may be added if required for foreign use.
- Elevation may be estimated to the nearest hundred feet.
- Exposure may be given by cardinal directions (8 points of the compass).
- Slope may be given as flat, gentle, average, or steep.
- Site class, if known, should be given according to USDA Tech. Bulletin 201.
- Soil: Identify as clay, loam, sandy, or gravelly - shallow, average, or deep.
- Tree description and stand description: Age: Determine by ring count at breast height.
- Bole: Clear length, straight, crooked, smooth or rough compared with neighbors.
- Bark: Rate in comparison with neighboring trees of equal age or size.
- Crown: Live length, pointed or round top, sides flat or wedge-shaped.
Angle of limb with stem--less than 90° if pointing up; more than 90° if drooping.
Density - size and number of limbs in comparison with neighbors.
- Stand description: For quarter acre around tree--larger area if known.
- Photograph: A good photo is very helpful in evaluating trees.
- Sketch map: Included to help locate the tree. Either paste in a section of map or make sketch tying in to local landmark such as a town or road crossing.
- The plus-tree location grid: This will be used to show the position of the plus tree in relation to near neighbors in the stand.

More detailed information such as flowering date, cone production, wood quality, etc., will be recorded as the registered tree is brought into use and the information is collected. This information will be recorded on an extra sheet and should include the following:

Tree Record: Flowering date, pistillate _____ staminate _____

Vegetative buds burst (date) _____ Fall buds form (date) _____

Flower and cone production in comparison with neighboring trees (better, equal, poorer) _____

Increment Core Record:

Rings per inch, first 10 years _____ last 10 years _____

Percent of summerwood, first 10 years _____ last 10 years _____

Specific gravity, first 10 years _____ last 10 years _____

Fibril angle, first 10 years _____ last 10 years _____

Other:

Broad Climatic Zones for Plus-Tree Registration and Seed Collection

The Douglas-fir region presents a wide range in climatic conditions, from north to south, from coast to valley, and from low to high elevations. Obviously, trees from all parts of the region cannot be used to develop a seed orchard for a particular locality. Therefore, the first logical step in setting up a register is to divide the region into broad climatic zones with reference, first, to atmospheric moisture; second, average annual and lowest minimum temperature, and latitude (photo period or length of day). Within these broad zones established weather stations (usually at lower elevations) will form the final check on the climatic condition of the point of origin of plus trees. Plus trees are now registered by rather broad climatic zones in Sweden 1/ and elsewhere.

Two sets of seed-collection zones have already been prepared for the region and are in use. 2/ 3/ They are based on temperature and moisture and do not differ greatly. With some slight adjustment, a similar set can be incorporated into this plan for the plus-tree register, the seed zones forming the first broad grouping of plus trees (figure 1). James Dick 4/ has worked out seed zones but is using a different approach; his zones are based on frost-free period and summer rainfall.

Forest trees are sensitive to a change in atmospheric moisture when moved to a new environment. Douglas-fir, western larch, and lodgepole pine from the dry atmosphere east of the Cascade Range died when planted in the Wind River Arboretum west of the summit; while the same species growing naturally west of the summit continue to thrive there. Trees of continental origin have not done well in the maritime climates of Europe and vice versa; they suffer from all sorts of needle diseases. Therefore, the first broad division in seed zones should be

1/ Lindquist, Bertil. Genetics in Swedish forestry practice. Stockholm, Sweden. 173 pp., illus. 1948.

2/ Kummel, Julius F., Rindt, Charles A., and Munger, Thornton, T. Forest planting in the Douglas-fir region. Forest Service, Portland, Oregon. 154 pp., illus. June 1944.

3/ Manning Seed Company. Tree seeds from the Pacific Coast. 28 pp., illus. 1954.

4/ Dick, James. Climatic zones of the Douglas fir region. Tacoma, Washington. Weyerhaeuser Timber Company. 4 pp., 2 maps. March 1955.

on the basis of atmospheric moisture--not only rainfall but relative humidity. This separates the region into three belts, two of which extend from the northern to the southern limits of the area. They are as follows:

- (A) The so-called fog belt between the Coast Range and the sea on the Oregon and Washington coast. This is a moist region with mild winters and cool summers.
- (B) The rain shadow area of the Olympic Mountains that includes a strip along the northeast end of the Olympic Peninsula, the eastern shore of Vancouver Island, and the Puget Sound and Coast Islands that lie to the east. Because of its proximity to the sea, it has a maritime atmosphere but has a low rainfall.
- (C) The drier interior valleys between the Coast Range and the middle elevation of the Cascades that extend from British Columbia south to the Siskiyou Mountains. It includes a dry area (zone 9) in the rain shadow (east and south) of the Coast Range and Klamath Mountains in southwest Oregon. The interior valleys have hotter summers and colder winters than the coast.

There is approximately 8° F. difference in average annual temperature between the Canadian and California lines; therefore, the fog belt and interior valley areas that extend from north to south have been further broken down into zones that have from 2° to 3° F. range in average annual temperature (figure 1). These are based on records of key stations of the U. S. Weather Bureau ^{5/} usually located at the middle or lower elevations in each zone. Within each zone colder temperatures and more moisture may be found at elevations higher than the weather stations. A brief description of these zones follows.

A - Fog Belt Zones

Zone 1.--The cold, moist zone on the northwestern tip of the Olympic Peninsula that is characterized by low maximum and high minimum temperatures. Its average annual temperature is from 47° to 49° F., and it

^{5/} Isaac, Leo A. Better Douglas fir forests from better seed. Seattle, Washington. University of Washington Press. 64 pp., illus. 1949.

has a minimum of 7° F., except at some inland stations that are colder. The annual rainfall varies from 80 to 123 inches.

Zone 2. -- The cool, moist zone of the fog belt that extends south from zone 1, Quinault Lake to the mouth of the Columbia River. The average annual temperature in this zone varies from 49° to 51° F., with a 4° F. minimum temperature and a rainfall of 60 to 126 inches.

Zone 3. -- The mild coastal zone that extends from Youngs Bay, Oregon, south to the Siuslaw River. Average annual temperature in this locality varies from 51° to 52° F., but it has a minimum that drops to zero. The rainfall varies from 60 to 94 inches.

Zone 4. -- This warm zone includes a broad coastal strip of highly productive forest that extends south from the Siuslaw River to Cape Blanco, and then on south in a narrow coastal strip to Cape Ferrelo. It has an average annual temperature of 52° to 53° F. along the coast and 55° F. in the interior with a minimum temperature of 14° F. It is moist but not wet, having a rainfall of 52 to 78 inches.

Zone 4a. -- This zone is the Douglas-fir - redwood association that extends from southern Curry and Josephine Counties, south to Mendocino County in California. It is logically a continuation of the fog belt and is similar to zone 4, but is warmer. The average annual temperature is 55° F. or higher, and rainfall varies from 50 to 80 inches.

B - The Olympic Rain Shadow Zone

Zone 5. -- This is the low rainfall zone in the rain shadow northeast of the Olympic Mountains in the northern part of the Puget Sound region. It has a maritime atmosphere but a low rainfall. It includes the northeast coast of the Olympic Peninsula and the Puget Sound Islands from Port Orchard north. The average temperature varies from 48° to 50° F. The minimum on the islands is +5° F., and on the mainland is -3° F. The rainfall varies from 18 to 36 inches per year.

C - The Interior Valleys Zones

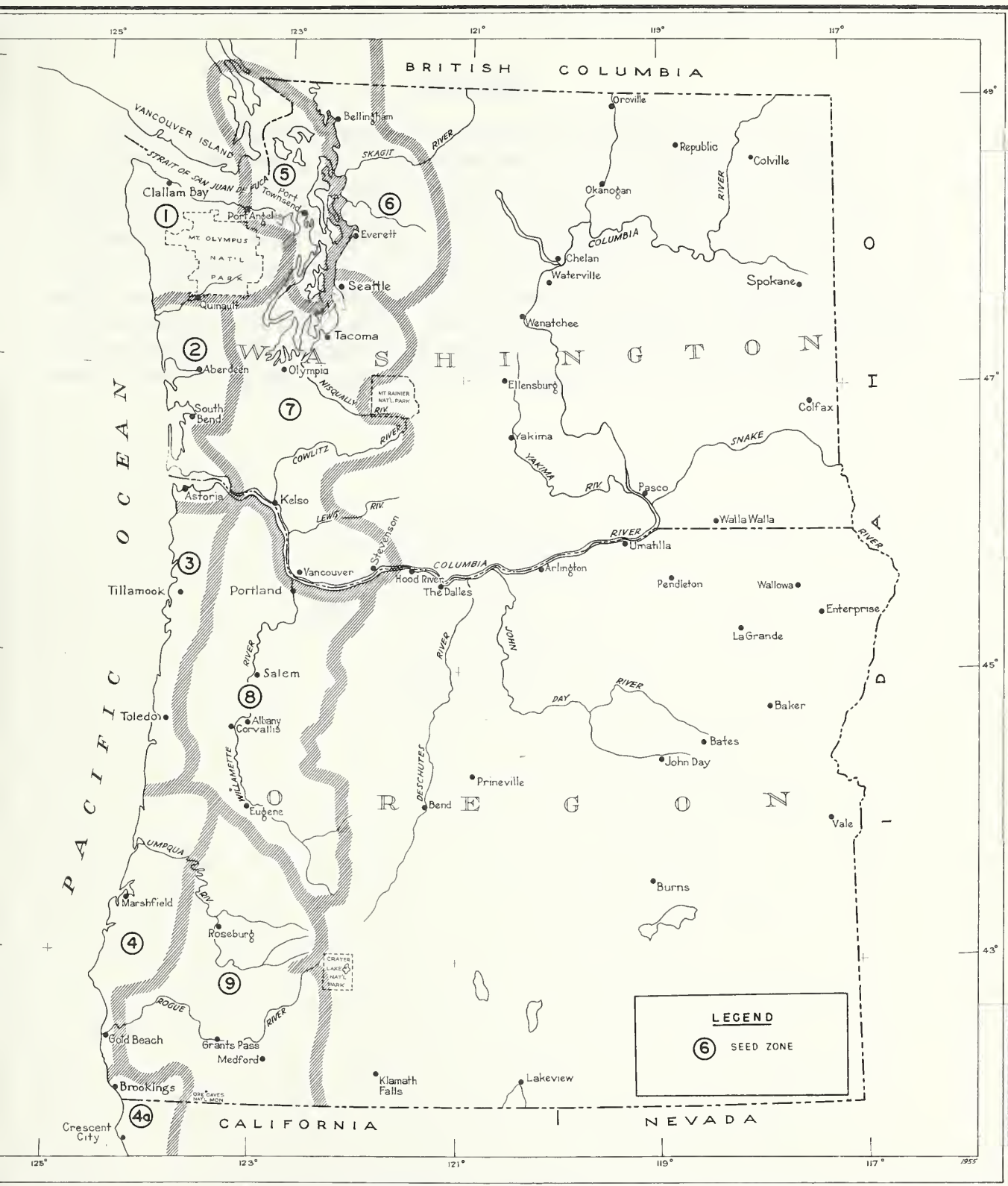
Zone 6. -- This is the cool northern zone on the west slope of the Cascades. It has more rainfall and has a lower minimum temperature than zone 5. The area extends along the lower slopes of the Cascades from Canada south to the Snoqualmie watershed. The average temperature varies from 49° to 50° F., but the minimum drops to -11° F. The average rainfall varies from 36 to 76 inches. Western British Columbia would be proportionally colder but not more moist.

Zone 7.--This is the first of the true broad interior valley zones where the middle of each zone is made up of agricultural lands. The fringes toward the Coast Range to the west, and up to the middle elevations of the Cascades to the east, constitute the forest areas. This zone extends from Seattle, south to the Columbia, and includes some of the poorer sites on the gravel outwash soils of Puget Sound as well as the better sites in the foothills. It varies in average annual temperature from 50° to 52° F. The minimum varies also, showing in some localities a minimum of $+10^{\circ}$ F. and dropping as low in others as -16° F. The rainfall varies from 30 to 60 inches.

Zone 8.--This zone includes the northern half of the Willamette Valley from the summit of the Coast Range to the middle elevations in the Cascades. It extends from the Columbia River, south to the Willamette-Umpqua divide. The average annual temperature varies from 52° to 53° F. with a minimum temperature of -15° F. Like the zone to the north, the rainfall varies from 30 to 60 inches.

Zone 9.--This zone includes the dry valleys of southwestern Oregon, in the rain shadow of the Coast Range and Klamath Mountains. There, as one proceeds southward, the Douglas-fir is replaced, for the most part, by ponderosa pine, and the forests in a few instances diverge from their characteristic even-aged condition to a somewhat all-aged forest. It extends from Cottage Grove, south into California. The average annual temperature varies from 53° to 54° F. but has a minimum as low as -10° F. The rainfall varies from 20 to 45 inches. Rainfall is not quite as low as zone 5 (the rain shadow of the Olympics), but it has the driest atmosphere and hottest summers of the Douglas-fir region in Washington and Oregon.

In the use of these climate zones for seed collection or the registration of plus trees, it should be understood that within each zone colder climates are found at elevations higher than the weather stations. Also within each division there may be good and bad strains of both Douglas-fir and its associates that the observer must learn to recognize.



GENERALIZED SEED ZONES
for the
DOUGLAS-FIR REGION OF OREGON AND WASHINGTON



Summary

Within our virgin stands of young and old Douglas-fir there are individual trees that are vastly superior to their neighbors. Rapid progress in our species-improvement program depends on the identification and location of these plus trees. Because their progeny cannot be arbitrarily shifted from one end of the region to the other, it is necessary that plus trees be sought out and located in each of the designated seed zones. Therefore, it is hoped that all agencies, public and private alike, will take part in this plus-tree program. Once this work gets under way, the Douglas-fir region will be well on the road to better seed sources and better growing stock for the forests of the future.

